UNITED
NATIONS

E

Economic and Social Council

Distr.
GENERAL

E/C.10/1992/4
11 February 1992

ORIGINAL: ENGLISH

COMMISSION ON TRANSNATIONAL CORPORATIONS
Eighteenth session
23-24 January 1992 and 8-15 April 1992
Item 4 of the provisional agenda*

GENERAL DISCUSSION ON TRANSNATIONAL CORPORATIONS IN THE WORLD ECONOMY AND TRENDS IN FOREIGN DIRECT INVESTMENT IN DEVELOPING COUNTRIES

Transnational corporations and economic growth through technology

Report of the Secretary-General

SUMMARY

A substantial body of empirical evidence from both developed and developing countries convincingly demonstrates that technology is a key determinant of growth. Indeed, in recent decades, technology has assumed greater importance than before in influencing growth. Transnational corporations develop the bulk of technologies, mostly in their home countries or other host developed countries. Therefore, in so far as technology drives growth, developing countries have to acquire technologies from transnational corporations from developed countries.

The analysis in the present report shows that foreign affiliates have made significant direct contributions to technological change and growth in host developing countries through increase in research and development expenditures, higher factor productivity and change in the composition of manufactured output and exports in favour of research-and-development intensive products. However, the evidence on spillover benefits arising from

* E/C.10/1992/1/Add.1.

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an integration with domestic economies, stimulation of local research and development, or technological alliances with local enterprises is mixed. Such benefits seem to depend on the host countries' own technological competence, level of human resources development and entrepreneurial capacity. In the light of these findings, the present report draws some policy implications concerning the choice between foreign direct investment and non-equity forms of technology transfer, performance requirements, terms and conditions of technology transfer, human resources development and the need for a holistic approach to policy formulation.

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INTRODUCTION

1. In resolution 1991/55, section I, adopted on the recommendation of the Commission on Transnational Corporations at its seventeenth session, 1/ the Economic and Social Council, inter alia, requested the Secretary-General to prepare for the eighteenth session of the Commission a consolidated report analysing the latest trends in foreign direct investment in the world economy, in particular its impact on developing countries. The present report is in response to that request.

2. The Commission has before it the report of the Secretary-General on recent trends in foreign direct investment (E/C.10/1992/3) which examines trends in foreign direct investment flows to developing countries. The Commission also has before it the report of the Secretary-General dealing with major new elements in the international economy (E/C.10/1992/5) which shows that remarkable changes in the structure of international economic relationships and policy paradigms have created conditions that place foreign direct investment and, more generally, transnational corporations in a position to play a central role in economic development. Taking these reports into account, the present report focuses on the linkage between technology and growth and, more specifically, the impact of transnational corporations on that linkage.

I. TRANSNATIONAL CORPORATIONS AND ECONOMIC GROWTH

3. Economic growth is a complex process that is an outcome of the interrelationship among many factors; some of these are economic, while others are political and social. A consensus is now emerging that environmental protection is also a necessary component of sustainable economic growth. Although the relationship between the physical environment and the magnitude and quality of growth is only beginning to be understood, any attempt to describe and analyse economic growth needs to take into account impact on the environment and the implications of that impact for the sustainability of a country's growth path.

4. Economic growth is driven by a number of forces. One major force is investment that augments and improves the productivity of a country's resources, physical as well as human. Trade can promote growth by allowing countries to exploit their existing comparative advantages and develop new ones, encouraging a fuller and more efficient utilization of domestic resources and enabling countries to reap the benefits of economies of specialization and participation in the international division of labour. Finally, growth can be driven by innovation and technological change, which not only improve the productivity of existing activities but also create comparative advantages in new ones. Thus, the elements underlying the growth process include investment, trade, technology and human resource development.

5. Transnational corporations are often thought of as responding to economic growth as they are induced, for a variety of reasons, to invest in expanding markets. However, as explained in other reports before the Commission, transnational corporations are emerging as increasingly important actors in determining the pace of growth, both directly and indirectly. Since investment is a major determinant of economic growth, foreign direct investment could promote growth by augmenting the existing capital stock. In addition, compared with domestic investors, foreign investors, by virtue of their possession of certain unique advantages, such as technology and access to marketing networks, may have a greater impact on the growth of host countries.

6. However, the indirect effects of foreign investment on host economies may also be significant, even though they are far more difficult to measure. Through its linkages with trade, technology, human resources and the environment, foreign direct investment may affect growth by impacting the host countries' trade performance, transferring technologies, employing and improving the quality of human resources and affecting the environment.

7. The above discussion shows that transnational corporations affect growth through several channels. A comprehensive analysis of the impact of transnational corporations on growth through these various channels is not feasible within the scope of a single report and will therefore be undertaken in the forthcoming study of the United Nations Centre on Transnational Corporations entitled World Investment Report, 1992 (ST/CTC/130), which provides the statistical basis for the present report. The present report limits itself to an evaluation of the role of transnational corporations in growth through the development and transfer of technology and a brief discussion of policy implications for developing countries.

II. TRANSNATIONAL CORPORATIONS, TECHNOLOGY AND GROWTH

A. Technology as a determinant of growth

Linkage between technology and growth

8. The concepts of technology and technological change encompass many dimensions. In some cases, technological progress involves process innovation, implying the finding of new ways to produce existing goods and services, often involving less use of resources; in other cases, such progress involves product innovation, implying the introduction of new products or improvement of quality. Technology comprises more than machinery and other forms of hardware embodied in physical goods: it can be considered "the stock of knowledge (technical or management)" 2/ used in production and marketing. Part of this knowledge is embodied in machines, but much of it is embodied in human skills, management methods, organizational structures and work routines. Technology, therefore, takes different forms: hardware such as machinery and equipment, software such as blueprints and process specifications, and the services of technicians and professionals for such

contributions as quality improvements, management and marketing know-how and process and product design. With the emergence of information technology as the central element in the production of many goods and services, the software and service components of technology are becoming increasingly important in the international economy.

9. The pervasiveness of the concept of technology, as indicated above, raises several problems in relating technology to growth. There is no single measure of the level of technology nor of the rate of technological change: it is not easy to separate the independent contribution of technology from other factors of production, particularly capital and labour, in which technology often becomes embodied. 3/ The impact of technology on growth depends on complex interactions among technological change, the structure of incentives confronting enterprises to apply, adapt and innovate upon available technologies, and institutional arrangements regarding, among other things, the flow of information and the functioning of markets. 4/

10. Despite the aforementioned problems, there is a consensus among analysts on the importance of technology as a determinant of growth. Technology is considered to promote growth in several ways. First, advancements in technology enable a country to obtain a greater output from any given combination of inputs. This means that the productivity of factors of production is enhanced by technology. Second, technology can promote growth through the production of new products (including qualitatively superior ones) with higher value added and greater income elasticity. Third (a point related to the above though deserving special mention), technology can foster growth through improved export performance which often requires a shift in the composition of exports from primary commodities to manufactures (and within manufactures to more technology-intensive products).

11. In recent decades, technology appears to have assumed an even greater importance for growth. For example, it has been noted that from about the mid-1970s per capita use of such commodity materials as energy, steel, copper and cement has been declining or levelling off, while per capita world gross domestic product (GDP) has been continuing its upward trend. The difference between the growth in the use of materials and the growth of GDP can be largely attributed to growth in the use of such knowledge-intensive new technologies as electronics, computers and those based on new materials. 5/ Consistent with this assertion, data show a generally declining trend in the intensity of raw materials per unit of GDP in developed market economy countries. 6/

B. Transnational corporations and technology development

12. It has been mentioned before that technology is linked to growth by permitting production, from a given amount of resources, of a greater amount or of new output. This requires new technological development which often involves research and development efforts. Results of research and development are in turn often reflected in patents. The present section

deals, therefore, with the role of transnational corporations in technology development as indicated by research and development and patents.

1. Transnational corporations and technology development: an overview

13. In recent years, a notable shift has occurred in the perception of the process of technology development. The conventional view - that scientific innovations and discoveries were largely achieved in academic institutions and research laboratories and that once these innovations and discoveries were in place, firms sought to commercialize them - is no longer appropriate. With the emergence of information-based technologies, the increasing globalization of enterprises and the growing competition in the international market-place, science and technology have become more and more linked. It is being increasingly recognized that a large part of technological development occurs because of actions taken by enterprises. 7/ In consequence, transnational corporations devote substantial resources to research and development, in addition to having a variety of institutional arrangements with universities, research institutions and other enterprises.

14. The proportion of sales spent by major companies on research and development far exceeds total national expenditure (for the same purpose) as a proportion of GDP. Furthermore, research and development expenditures of those companies constitute a significant share of total national expenditures. (Most of them are transnational corporations.) Most major transnational corporations, recognizing the key importance of technologies, have undertaken extensive research programmes. Such transnational corporations as IBM, General Electric, Hitachi, General Motors and Siemens have allocated funds amounting to billions of dollars annually for research and development (see table 1).

15. Research and development expenditures reflect the resources devoted to technological development. They are therefore an input indicator. Results of research and development often find expression in patents which can be viewed as an output indicator of technological development. Here again, data on patents registered in the United States of America clearly show the dominant role of corporations. Foreign-owned corporations together with those of United States origin account for over three fourths of patents registered in the United States; the share of foreign-owned corporations appears to have increased from about the mid-1980s and is now larger than that of domestic firms. Overall, the development of technologies appears to be increasingly internalized within transnational corporations.

Table 1. Research and development expenditure by top 20 transnational corporations, 1990

(Millions of dollars)

Transnational corporation	Research and development expenditure
Non-United States corporations	
Siemens	4 132
Hitachi	3 011
Matsushita Electric Industrial	2 423
Philips Electronics	2 411
Alcatel Alsthom	2 237
Fujitsu	2 097
Toshiba	1 864
Nippon Telegraph & Telephone	1 739
NEC	1 728
Bayer	1 699
United States corporations	
General Motors	5 342
IBM	4 914
Ford Motor	3 558
AT&T	2 433
Digital Equipment	1 614
General Electric	1 479
Du Pont	1 428
Hewlett-Packard	1 367
Eastman Kodak	1 329
Dow Chemical	1 136

Source: Robert Buderi, "A tighter focus for R&D", Business Week (1991 bonus issue, "The Quality Imperative", December 1991), pp. 170-172.

2. The internationalization of technological development and transnational corporations

16. Historically, transnational corporations undertook technological development mostly in their home countries. Foreign affiliates generally undertook modifications of and adaptations to innovations emanating mainly from the research and development establishments of their parent firms in home countries. This is still the predominant pattern. In recent times, however, there has been a marked growth in the internationalization of research and development. As transnational corporations become progressively more global and acquire a world orientation for their input, products and markets, a number of them are establishing an integrated system for research and development, with overseas laboratories playing a significant role. The increasing importance of economies of scope, shorter product cycles and rapid obsolescence, all of which require closer interaction with customers, has necessitated such an internationalization. In some cases, internationalization has been motivated by the desire to take advantage of scarce scientific and technical personnel with respect to which particular host countries possess a comparative advantage. At the same time, the process has been facilitated by the development of transnational computer communication networks and on-line systems that permit smooth flow of data and information among remote sites and, indeed, on-line conduct of research and development. 8/

17. No comprehensive data exist on the geographical distribution of research and development efforts of transnational corporations by country of ownership; however, the sketchy evidence available from limited survey data lends support to a growing internationalization. In the case of United States transnational corporations, the proportion of research and development expenditure accounted for by foreign affiliates increased from 7 per cent in 1966 to 10 per cent in 1989. 9/ Swedish transnational corporations have reached a considerably higher degree of internationalization of their research and development expenditures, and that trend is continuing: some 23 per cent of research and development expenditures by 20 Swedish transnational corporations were undertaken abroad in 1987 compared with 21 per cent of such expenditures by the same firms in 1980. 10/ In the case of transnational corporations from Germany, it has been noted that the growth of research and development employment abroad has risen much faster than the growth of total employment abroad. In a survey of 33 firms, it was found that 18 per cent of their total research and development employees in 1989 were employed in affiliates abroad. 11/ In contrast, a survey of 11 large transnational corporations from Germany at the end of the 1970s had revealed that 15 per cent of their research and development personnel were employed abroad. 12/ Data on patents generally also indicate a rising importance of research and development in foreign locations.

18. In sum, transnational corporations account for the bulk of research and development expenditures in their home countries, which are in turn the global leaders in technological development. A small but increasing share of these expenditures is being shifted to host countries, albeit primarily to developed ones.

19. Obviously, technology development is the prerequisite for the improved factor productivity and product innovations that, in turn, fuel growth. By virtue of their dominance in technological development, transnational corporations play a major role in the growth process; and this role is likely to become of greater importance in the future because of the increasing importance of technology as a determinant of growth.

C. Transnational corporations and the transfer of technology to developing countries

20. The preceding section has demonstrated the importance of transnational corporations in the development of technology at the global level. The focus of analysis in the present section is on their role in technology transfer to developing countries. The rationale is that since technology development by transnational corporations takes place mostly in their home countries or in other host developed countries (as demonstrated in the preceding section), access to technologies for developing countries is largely a matter of acquiring those technologies from transnational corporations in developed countries in order to accelerate growth. In this context, it should be noted that only 2 per cent of total research and development expenditures of 11 German transnational corporations surveyed at the end of the 1970s occurred in developing countries. 13/ In the case of United States transnational corporations, 5 per cent of foreign research and development expenditures occurred in developing countries in 1982, and this proportion declined to 4 per cent in 1989. 14/

21. The principal sources of technology acquisition are scientific and technical publications (typically widely accessible at low cost), trade (through the import of machinery and equipment), foreign direct investment (both through wholly-owned foreign affiliates and joint ventures) and non-equity links with transnational corporations through such mechanisms as patents, licences, technical assistance agreements and other contractual arrangements, as well as strategic alliances. Transnational corporations play a major role in all these modes of transferring technology, particularly in trade, foreign direct investment and non-equity links.

1. Transnational corporations and the supply of capital goods

22. The import of capital goods is a prime determinant of the productive capacities of developing countries. During the decade of the 1980s, developing countries in Africa recorded a significant decline in the absolute value of capital goods imports, those in Latin America and the Caribbean achieved only a marginal increase and those in Asia and the Pacific raised their imports by nearly three fourths. The import of capital goods is undoubtedly a significant explanatory variable in the differential growth performance of these groups of countries.

23. The key issue in the present context is the role of transnational corporations in capital goods imports. The non-availability of data does not permit a disaggregation of imports of capital goods from transnational corporations as compared with imports of such goods from other entities. However, indirect evidence suggests a major role for transnational corporations in the supply of capital goods. For example, in 1988 at least 80 per cent of United States foreign trade was undertaken by transnational corporations, including parent companies in the United States, foreign affiliates of United States transnational corporations and United States affiliates of foreign transnational corporations. 15/ It is not unrealistic to assume that the proportion of capital goods imports by developing countries from United States transnational corporations is at least equal to, if not higher than, 80 per cent.

24. It should be noted that a large part of capital goods imports takes place as arm's-length transactions between importing countries and transnational corporations. These imports thus represent an unpackaged form of technology transfer - technology being embodied in capital goods - but the choice of technology in such cases rests primarily with the importing firms. Consequently, technology's impact on growth in specific situations will largely depend on the ability of the host countries' enterprises to make the right choices in the light of available alternatives and on their capacity to utilize imported capital goods effectively.

2. Technology transfer through foreign direct investment

25. A transnational corporation normally undertakes foreign direct investment when it possesses certain technological or other economic advantages over its competitors and finds that it is in its own best interest to exploit those advantages internally from a foreign location. 16/ Technology forms an important part of a transnational corporation's competitive advantage, and many firms choose to service their foreign markets through foreign direct investment, not only to exploit that advantage but also to retain company control over their technology. Hence, foreign direct investment may be the only way for many developing countries to gain access to certain key technologies.

26. Foreign direct investment can promote technological change in developing countries in a number of ways. Direct impact may occur through its contribution to higher factor productivity, changes in product and export composition, research and development undertaken by foreign affiliates, introduction of improved management practices, and employment and training. Indirect impact occurs through collaboration with local research and development institutions, technology transfer to local downstream and upstream producers, effect of the presence of foreign affiliates on competition and on the efficiency of local producers, and turnover of trained personnel.

(a) Direct effects

(i) Transnational corporations and factor productivity

27. An important contribution of technology to growth is through increased factor productivity. An evaluation of the contribution of transnational corporations to this process would require highly disaggregated data on the use of factors of production and value added, differentiated by ownership in different industries. Such data are not readily available.

28. However, there are case-studies that provide some evidence on relative efficiencies in the use of factors of production by foreign affiliates and domestic enterprises. For example, an analysis of 282 pairs of foreign and domestic firms of similar size drawn from 80 manufacturing industries in Brazil concluded that foreign firms had a significantly higher ratio of value added to output. 17/ In a study on Thailand it was found that foreign firms had higher average productivity of both capital and labour in the manufacturing sector compared with domestic firms and that that higher productivity was due to the higher efficiency of foreign firms as measured by a technology coefficient derived from production function estimations. 18/ Similarly, in another study, on the Republic of Korea, it was observed that the marginal product of both capital and labour was higher in foreign firms compared with domestic firms, but that the differential was much greater for capital than for labour. 19/

29. All these studies therefore support the view that foreign firms can contribute to growth through the provision of technologies that make more efficient use of capital and labour.

(ii) Transnational corporations and product composition

30. It has been noted earlier that one of the ways in which technology promotes growth is through the introduction of new products or qualitatively superior old products. Transnational corporations can play a role in this process. One way of assessing that role is to examine the role of transnational corporations in the production of relatively more research-intensive products. For United States transnational corporations, the expansion of the share of sales of high- and medium-research-intensive industries occurred primarily in Asia and the Pacific. In that region, United States affiliates also had the largest increase of research and development expenditure as a percentage of sales, as noted earlier. For Latin America, there has been much slower growth in sales of high- and medium-research-intensive industries; in Africa, there has been a decline. For Japanese transnational corporations, the picture is similar as far as Africa is concerned. Once again, there has been an increase in the share of sales of high- and medium-research-intensive industries in manufacturing sales in Asia and the Pacific as well as in Latin America, with a slightly more pronounced growth in the latter region in terms of the share of manufacturing sales.

31. The creation of production facilities by transnational corporations in high- and medium-research-intensive industries can imply technology transfer not merely through a changing product composition, but also through training of host country personnel in new technical skills, introduction of new management methods and new ways of organizing the production process. However, the impact of foreign direct investment on the transfer of skills from host country personnel not only depends on the degree of complexity of the technology employed but is also a function of the methods used for transferring skills, the quality of in-house training programmes, the promotion policy for nationals through exposure to progressively higher levels of responsibility and the provision of off-the-job training.

(iii) Transnational corporations and export composition

32. The technological content of exports can be an important determinant of growth performance. It is well known that research-and-development-intensive exports generally have higher income elasticities; therefore, the growth of these exports is more sustainable over the longer run. Besides, a rising share of such exports also carries the implication that the country concerned is in a position to exploit a dynamic comparative advantage (manifested in the growth of internationally competitive research-and-development-intensive industries), rather than rely exclusively on a static comparative advantage based on natural resources endowment or low labour cost. The role of transnational corporations in the export of research-and-development-intensive products therefore deserves scrutiny.

33. Data show that, in the case of Japanese affiliates, the share of research-and-development-intensive exports in total manufactured exports increased between 1982 and 1989 in Latin America and Asia, but declined in Africa (where there has also been an absolute decline of research-and-development-intensive exports). In the case of United States affiliates, their share of research-and-development-intensive exports increased somewhat in Latin America, declined slightly in Asia (though the share was still much higher than in Latin America) and remained very small in Africa. On the whole, affiliates have significantly increased research-and-development-intensive exports.

34. However, it should be noted that the performance of transnational corporations in this respect was not necessarily better than that of local enterprises. In particular, local enterprises in Asia clearly outperformed foreign affiliates. Total research-and-development-intensive exports from this region in 1989 were more than four times those recorded in 1982; 20/ but the increase in research-and-development-intensive exports by both United States and Japanese affiliates over the same period, though significant, did not reach a similar level.

(iv) Research and development by affiliates

35. It was noted earlier that an overwhelming proportion of the foreign research and development of transnational corporations is located in developed countries. This does not necessarily imply that such research and development is insignificant from a host country perspective. In countries such as India, the Republic of Korea and Singapore, the share of aggregate research and development expenditure attributable to foreign firms exceeded 15 per cent in the 1970s. 21/ Moreover, there is some evidence that foreign affiliates may be devoting more of their resources to research and development than before. There has been a noticeable increase in research and development expenditures as a proportion of sales of majority-owned foreign affiliates of United States transnational corporations in a number of developing countries, albeit with some noticeable regional differences. Research and development expenditure by United States affiliates as a percentage of sales increased fourfold between 1982 and 1989 in Asia and the Pacific, while stagnating in Latin America and remaining insignificant for the developing countries in Africa.

36. The location of research and development activities in developing countries can be explained by locational advantages and corporate strategies of transnational corporations. The decisions of corporations to locate research and development activities in certain host countries are very much dependent on such factors as the availability of research and development facilities and trained scientific and engineering personnel. Generally, countries with high research and development expenditures are also the countries in which United States affiliates have a high proportion of such expenditures compared with sales.

37. Very little is known of the type of research undertaken by foreign affiliates of transnational corporations. The research and development activities that take place within foreign affiliates are most likely to be typically confined to adapting the parent company's technology to local conditions. The effect of transnational corporations on deeper indigenous research and innovation capabilities (know-why) in developing countries is less evident. Since transnational corporations can import all their know-why and need only perform adaptive research in host countries, local firms may well conduct more research (as opposed to development) than foreign affiliates.

38. It may also be that a strong presence of transnational corporations can inhibit the development of an indigenous technological base beyond adaptive research. 22/ When transnational corporations penetrate a host country market, indigenous firms may be forced to cut back on research or narrow their field of specialization as they are confronted with declining market shares caused by competition with transnational corporations possessing much greater technological capacities. On the other hand, foreign competition could also induce domestic firms producing similar products to undertake research and development that would otherwise not take place in order to improve their competitive advantage. In this case, foreign direct investment could advance local innovatory capacity in areas in which the host country and its firms are strongest and have a competitive market structure. In the case of those

greenfield investments with no competition with local industry, there is no displacement of local enterprises, and foreign direct investment will most likely lead to a net increase in a host country's innovatory capacity even through adaptive research. 23/

(b) Indirect effects

39. Foreign direct investment can promote growth through several indirect mechanisms of technology transfer. For example, backward linkages to local firms through subcontracting the supply of parts, components and services create additional demand for intermediate products. A supplier firm in a developing country that is in a subcontracting relationship with a foreign subsidiary can receive technical assistance to improve product quality or the production process or to undertake new product development. When upgrading the technological level of supplier industries, foreign direct investment often increases the local value added and generates growth. The presence of foreign affiliates can increase competition and thereby force domestic enterprises to improve productive efficiency which is growth-enhancing.

40. There is some evidence that transnational corporations may be increasing their use of input from local resources. Local procurement by Japanese affiliates showed increasing levels for all industries from 1981 to 1988, especially in Asia. In 1988, Japanese affiliates procured more than 40 per cent of their input locally in Asia and 30 per cent in Latin America. Procurement levels were also high for such medium- and high-research-and-development-intensive industries as chemicals, general machinery, electric machinery and transport equipment. Through comparison of the local procurement levels for these industries, it has been found that such levels are generally higher for the newly industrializing economies than for other Asian countries, particularly in more technology-intensive industries. This finding indicates that existing local technological capabilities influence the extent of procurement.

41. Some case-studies also show that affiliates of transnational corporations have made extensive use of supplier linkages in host countries and impart considerable training and technical and financial assistance to their local suppliers. For example, a recent survey of 63 large foreign affiliates operating in Mexico's manufacturing sector 24/ found an extensive use of local subcontracting: almost two thirds of the foreign affiliates (37) had subcontracted locally. Of these 37 firms, nearly one third had subcontracted more than 25 per cent of their total production value. This outcome had been the result of a combination of performance requirements, the existence of a capable supplier network and industry-specific corporate strategies. The survey also found that the local subcontracting of inputs in Mexico by affiliates of transnational corporations had been motivated to a large extent by efficiency considerations which had assumed a greater role in the calculus oftransnational corporations as the country shifted from an import-substitution regime to an export-oriented regime with a liberalized trade policy. The survey further revealed that almost all of the foreign affiliates that had subcontracted locally imparted some kind of training to their

national subcontractors: 87 per cent had provided training in quality control, 68 per cent had given some kind of technical assistance and 22 per cent had offered financial assistance to their subcontractors.

42. In Indonesia, however, it seems that affiliates of transnational corporations have used local inputs primarily because of government pressure. 25/ In response, most foreign affiliates have preferred to manufacture in house and subcontract only a few insignificant and non-essential items. Consequently, the technical, managerial and financial linkages between transnational corporations and the subcontractors have generally been weak. Accordingly, the technology spin-offs through subcontracting in Indonesia have been minimal. To a significant extent, this is due to the absence of competitive domestic supplier industries.

43. As to the "spillover" impact of transnational corporations on the technological capacity and productive efficiency of indigenous enterprises, several studies on developed countries provide mixed evidence. 26/ The same is true for developing countries. A recent study on Mexico showed that the rate of productivity growth of local firms and their ability to reach the productivity standards of transnational corporations were positively related to the degree of foreign ownership of an industry. 27/ This was interpreted as implying that Mexican firms had been forced by the competition from foreign affiliates to increase productivity by investing in human capital and new technology. However, the study could not exclude the possibility that the competitive pressure from foreign affiliates had simply forced out inefficient local firms, thus improving the average productivity performance of Mexican firms. In contrast, a study on Morocco did not provide any evidence that the presence of foreign firms had resulted in increased productivity of domestically owned firms. 28/ Although foreign firms had higher levels of productivity, domestic firms showed faster productivity growth. However, these findings could not be attributed to dynamic externalities from foreign direct investment.

44. In some cases, transnational corporations stimulate technology development by local research and development institutions. In India, for example, one transnational corporation very recently signed a letter of intent with a government-funded telecommunications research and development facility, the Centre for the Development of Telematics, to use switches designed by the Centre in a new open-architecture cellular system. In addition, the transnational corporation will sponsor research at nine leading engineering colleges. 29/

3. Transnational corporations and technology transfer through non-equity forms

45. Apart from wholly- or majority-owned foreign direct investment (usually known as internalized forms of transfer), transnational corporations also transfer technologies through a variety of externalized (non-equity) forms. These include minority joint ventures, licensing, management and marketing contracts and international subcontracting. However, data on such technology

transactions between developing countries and transnational corporations are sketchy and difficult to interpret. Few developed countries disaggregate their technology receipts by country, type of transaction (for example, licensing or management contract) or relationship between receiving and paying enterprise (affiliate or unrelated enterprise). Similar comments also apply to developing country data on technology payments. Hence, it is a formidable task to assess the role of transnational corporations in technology transfer through such forms and harder still to assess the impact of those forms on growth.

46. An earlier study by the United Nations Centre on Transnational Corporations concluded that during the 1970s and up until the mid-1980s, the incidence of externalized forms of technology transfer seemed to have increased. 30/ Data on United States transnational corporations suggest a weak corroboration of that trend. However, attention should be drawn to the fact that technology receipts from unaffiliated enterprises in developing countries account for a very small proportion of total receipts.

47. Host country data tell a similar story. For example, in the Republic of Korea the share of payments for foreign licensing and technology contracts in total technology-transfer transactions (defined as foreign direct investment inflows plus payments for foreign licensing and technical consultancy plus capital goods imports) increased from 1.2 per cent in 1972-1976 to 1.6 per cent in 1982-1986. 31/ In Thailand, technology payments (comprising payments for royalty, trade marks and technical and management fees) increased from a range of 0.08-0.10 per cent of GDP during the period 1972-1976 to 0.19-0.20 per cent during the period 1984-1987. 32/

48. Several points need to be considered to put this pattern into perspective. The first concerns its future trend. It is well known that many factors - such as the age and sophistication of a technology, industry characteristics and corporate strategies within particular industries, as well as the level of a host country's entrepreneurial, technological and human resources development - affect the choice of particular transnational corporations regarding externalized technology transfer. However, this form of transfer may be even less favoured in the future than in the past. For one thing, recent developments in information technologies tend to increase the internalization advantages of transnational corporations. These developments facilitate, and cheapen the cost of, intrafirm communication, coordination and control. High costs of development and rapid obsolescence are likely to reinforce efforts of transnational corporations to secure a quicker payback through internalization. Furthermore, the internalization of research and development expenditure noted earlier and the trend towards strategic alliances among transnational corporations in respect of the development and transfer of technologies limit the plurality of sources in the technology market. The deceleration in the growth of external resource inflows through official development assistance and private flows other than foreign direct investment would limit the ability of developing countries to acquire unpackaged technology. Finally, recent policy changes in developing countries in favour of foreign direct investment tend to reduce the cost of

internalization. These factors are likely to increase the importance of foreign direct investment as an instrument of technology transfer.

49. The second observation relates to the interrelationship between foreign direct investment and externalized technology transfer. With the exceptions of India and the Republic of Korea, the bulk of technology receipts of United States transnational corporations from unaffiliated enterprises in developing countries originate precisely in economies (such as those of Argentina, Brazil, Hong Kong, Indonesia, Malaysia, Mexico, the Philippines, Singapore, Taiwan Province of China and Venezuela) that are also among the largest host countries of foreign direct investment. Thus, familiarity with a country's enterprises and their capability gained through foreign direct investment may be a precondition for (or, at least, a facilitator of) externalized forms of technology transfer. In the case of India and the Republic of Korea, a combination of restrictive policies towards foreign direct investment, availability of a substantial pool of well-trained human resources and large market size encouraged externalized forms of technology transfer despite comparatively less foreign direct investment.

50. Third, the growth impact of technologies transferred through externalized forms depends, as in the case of capital goods imports, largely on the capacity of domestic entrepreneurs to make the right selection, use the acquired technologies effectively and adapt and innovate continuously. Also relevant to the growth-promoting impact of technologies acquired through externalized forms is the capacity to negotiate reasonable terms. There are many imperfections in technology markets that give rise to a considerable scope for bargaining. If technology purchasers are not equipped with adequate knowledge concerning the availability of alternative sources of the same or similar technologies and their costs, transactions are very likely to be settled in terms more favourable to the sellers. In the case of Thailand, for example, it has been observed that there was no correlation between licensing fees and the complexity of technologies; fees were paid for technologies no longer covered by patents; and technical fees paid for similar technologies in the pharmaceutical industry ranged from 0.4 per cent to 20 per cent of sales. Even though many of the buyers were aware that these terms were disadvantageous, they did not have adequate information on alternative sources. 33/

4. Strategic alliances and technology transfer

51. High risks and rising research and development costs (especially in the area of new technologies) and the rapid obsolescence of new products have forced many transnational corporations to form technology-related strategic alliances to share development costs, acquire new technologies and make better use of scarce qualified personnel. 34/ The substantial number of strategic alliances now in existence is a relatively new phenomenon, and it is very difficult to obtain precise data on their frequency and purpose. However, there are indications of an emerging trend towards a very high proportion of agreements involving development of and access to technologies. 35/ IBM's

alliances with several other corporations for the purpose of developing its personal computer are an example: the Lotus Corporation provided the application software and Microsoft wrote the operating system for a micro-processor that was produced by Intel. 36/ IBM (traditionally reluctant to conclude alliances) has now created alliances with more than 40 partners all around the world (with Siemens of Germany, among others), pooling technology and customer bases in the telecommunications and related fields. As a response to competition from IBM, the Japanese computer firm Fujitsu has formed alliances with Texas Instruments, Siemens and Hitachi. Table 2 illustrates the growth of technology alliances among transnational corporations, often undertaken for the joint development of new generations of products and for the setting of industry standards. The alliances are centred on the Triad of Europe, Japan and the United States of America and are most frequent in information technology.

Table 2. Number of new technology alliances among transnational corporations from Europe, Japan and the United States of America by industry, 1980-1984 and 1985-1989

Industry	1980-1984	1985-1989
Information technology	348	445
Biotechnology	108	198
New materials	63	115
Automotive	26	79
Chemicals	80	103

Source: Maastricht Economic Research Institute on Innovation and Technology, as quoted in The New York Times, 1 January 1992.

52. Technological alliances can be viewed as a way of providing collective protection to technological advances among a few partners. The increasing incidence of such alliances combined with the current pace and cost of technological development makes it more difficult for developing countries to acquire technology through traditional non-equity arrangements. Many alliances also involve common actions for setting international standards that increase the barriers (including those for new products from developing countries) to entry into the international market. However, some developing countries, particularly the newly industrializing ones, have the potential and

capability to become partners of technology alliances. In the information technology industry, for example, Taiwan Province of China has made extensive use of alliances with transnational corporations to acquire technological capabilities. A typical example of such efforts has been in the area of computer software, where the Government set up two software engineering firms in cooperation with IBM. 37/ Taiwan Province of China has provided good-quality engineers at a relatively low cost while IBM has provided experience in software research and development. Similarly, the Sony group is to transfer advanced technology to the electronics industry in Taiwan Province of China. (Sony has announced that it has entered into alliances with 130 electronics companies from Taiwan Province of China and is working with a "technology development centre" to create a production base for export to Japan and Sony's affiliated companies worldwide.) 38/ Similarly, several firms in the automobile industry in the Republic of Korea have entered into alliances with transnational corporations from the Triad. Examples of those alliances include that of Hyundai with Mitsubishi and Chrysler; that of Daewoo with General Motors, Suzuki and Isuzu; and that of Kia with Ford and Mazda. 39/

III. TOWARDS AN ASSESSMENT

53. The present report has shown that technology is a key determinant of growth. Technology promotes growth by increasing factor productivity, enabling the introduction of new products with greater long-run income elasticities and bringing about shifts in export composition in favour of research-intensive exports with higher growth potential. In recent decades, the importance of technology as a determinant of growth appears to be increasing.

54. Transnational corporations are responsible for the bulk of technological developments. Therefore, in so far as growth is driven by technology, the growth and development of developing countries are closely bound to a variety of equity and non-equity links with transnational corporations that permit access to technologies.

55. One channel of access to technology is through the import of capital goods, in the supply of which transnational corporations play a dominant role. While the choice of technologies acquired through this mechanism largely rests with domestic importers, transnational corporations also contribute to growth through this mechanism, albeit indirectly.

56. Foreign affiliates can promote technological change in developing countries - and thereby growth - through their own research and development. During the last decade, data for United States majority-owned affiliates in developing countries show that the shares of research and development expenditures in sales, though small, has increased. The net impact on growth arising from increased research and development expenditure by foreign affiliates also depends on what effects such an increase has on indigenous firms' research and development capabilities. In general, it appears that the effect is likely to be more beneficial where domestic firms are capable of

undertaking research and development to meet the challenge of competition from foreign affiliates. Foreign affiliates generally appear to exhibit higher factor productivity which contributes to growth. They also appear to have contributed to the growth of developing countries through increasing the share of research-and-development-intensive products in their total sales and their manufactured exports over the past decade. However, domestic enterprises in Asia outperformed transnational corporations in respect of research-and-development-intensive manufactured exports.

57. Foreign affiliates have also contributed to the growth of developing countries indirectly by increasing their purchase of local inputs; but the level and nature of such purchases is conditioned by the level of the host country's industrial development. In some cases, foreign affiliates have also stimulated research and development by local institutions through collaborative arrangements. Sparse information on these arrangements does not allow any conclusion about the overall effect of such stimulation of growth.

58. In some cases, a growth stimulus has also been generated through significant technology transfer by transnational corporations via such non-equity channels as licensing. The countries that have benefited most from such transfers appear typically to be the largest host countries. Sometimes, those transfers involved unfavourable terms that implied an avoidable drain on domestic resources.

59. Recently, there has been an upsurge of technological alliances among transnational corporations, particularly in respect of new technologies. That upsurge raises concern about the possibilities of reduced competition in the international technology market and restrained access to developing countries. These possibilities could limit the potential for contributing to growth through the dissemination of new technologies.

60. In sum, transnational corporations are making a significant direct contribution to the growth and technological development of host developing countries through the research and development expenditure of affiliates, changes in their product and export composition and higher factor productivity. As to the indirect stimuli to growth through non-equity forms of technology transfer, integration with domestic economies, stimulation of local research and development and technological alliances with developing country enterprises, the evidence is rather mixed. The beneficial impact of these mechanisms appears to be largely contingent on, inter alia, the host country's domestic capacity to generate and adapt acquired technologies, the competitive ability of domestic enterprises and the availability of well-trained human resources. It may be concluded, therefore, that as regards indirect stimuli to growth through a wider dissemination of technologies, transnational corporations can strengthen a country's technological base where the above-mentioned conditions already exist but are unlikely to create those conditions.

IV. SOME POLICY IMPLICATIONS

61. Several policy implications emerge from the findings in the present report. For one, research and development by foreign affiliates in developing countries appears to be located mainly in those countries that already possess some domestic technological competence and a reasonable supply of trained scientific and technical personnel. Policy measures directed towards inducing transnational corporations to undertake greater research and development in host economies should therefore be conceived in the broader context of a country's indigenous technological development policy, encompassing, inter alia, the creation of an adequate human resources base for technological activities.

62. As noted earlier, foreign direct investment has made a notable contribution to technology transfer, and thereby to growth, through changes in the composition of products and exports in favour of greater technological intensity. Here again, performance variations of transnational corporations appear to be related to host economies' indigenous technological capacities; hence, the conclusion noted above with regard to inducing transnational corporations to undertake greater research and development in host economies is applicable here as well. In addition, it should be pointed out that while foreign direct investment may be a useful means of quickly benefiting from the results of new innovation abroad through the transfer of production, it does not necessarily imply a dissemination of technological knowledge to domestic producers. This raises the question of the choice between foreign direct investment and externalized forms as mode of transfer. There have been contrasting experiences in respect of this choice, even though national growth performance has been quite comparable. Singapore can easily be cited as a case involving large reliance on foreign direct investment, while that of the Republic of Korea represents a greater reliance on externalized forms, which was facilitated by both the creation of an ample entrepreneurial skill base and governmental assistance to local enterprises by providing information and support in bargaining. Any country seeking to pursue a similar strategy would be well advised to evaluate carefully the level of its human resources development, the entrepreneurial capacity of domestic producers and the ability of Governments to provide appropriate information and guidance to them. It should also be pointed out that restrictive policies towards foreign direct investment may severely limit access to sophisticated technology, as the experience of India amply demonstrates. Furthermore, even the Republic of Korea has chosen to liberalize its foreign direct investment policy progressively since the early 1980s as the country needed more modern technologies to sustain international competitiveness. In 1991, India also announced a significant departure from its past policies in the direction of permitting easier access to foreign direct investment.

63. In the context of the varying performance of transnational corporations in respect of linkages with the domestic economy, the question of performance requirements assumes relevance. Quite obviously, for example, if the objective is to promote efficiency in the use of resources in order to promote faster growth, the imposition of a local content requirement in the absence of

an internationally competitive supplier industry would be counterproductive. However, there may be a case to be made for a highly selective use of such a requirement in the event of a high probability that local producers would be able to quickly achieve international standards with assured demand for their products. 40/

64. Even where transnational corporations are willing to transfer technologies in externalized forms, the terms of transfer may sometimes leave something to be desired, as the experience of Thailand (cited earlier) demonstrates. Excessive payments imply a drain on domestic resources and thus may inhibit growth. Technology purchasers should therefore be provided with adequate information regarding available alternatives to enable them to make informed choices. An arbitrary imposition of limits on royalty payments or licence fees is likely to limit access to desired technologies.

65. A correlation appears to exist between foreign direct investment and access to externalized forms of transfer in most cases. Hence, highly restrictive policies towards foreign direct investment may also limit the scope for acquiring technology through other channels, unless the country concerned has a strong bargaining position because of its large market size or the capacity to develop technologies independent of an association with transnational corporations. The link between foreign direct investment and externalized forms also raises a formidable technology barrier for the vast majority of developing countries which attract little foreign direct investment due to their structural constraints, no matter how liberal their national policies towards such investment.

66. The present report has also shown that there is a marked tendency among transnational corporations to hold on closely among themselves to new technologies through strategic alliances. There have been, at the same time, some instances of such alliances with developing country enterprises. Local enterprises therefore deserve to be encouraged to enter into these types of arrangements with transnational corporations from advanced countries wherever possible, in order to gain access to new technologies or to be able to apply them more widely in the interest of sustaining competitiveness and growth.

67. Finally, it should be emphasized that the growth-promoting impact of technologies acquired through foreign direct investment as well as through other forms of association with transnational corporations is ultimately dependent on the incentive structure faced by both foreign and domestic enterprises in acquiring, adapting, innovating upon and diffusing technologies. The incentive structure is conditioned by a host of public policies concerning, inter alia, physical infrastructure, human resources development, research and development, technology and foreign direct investment, competition, international trade, factor pricing, venture capital and subsidies. The formulation of such a holistic approach is no doubt immensely complex, but without that kind of approach the contribution of transnational corporations to growth through technology transfer will fall short of its potential.

Notes

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